4. a) $(-2x^2 + 4x - 2) - (-x^2 + 3x - 1)$ — Subtract each term.
$= -2x^2 + 4x - 2 - (-x^2) - (+3x) - (-1)$ — Add the opposite terms.
$= -2x^2 + 4x - 2 + x^2 - 3x + 1$ — Collect like terms.
$= -2x^2 + x^2 + 4x - 3x - 2 + 1$ — Combine like terms.
$= -x^2 + x - 1$

b) $(x^2 - 5x - 4) - (x^2 - 4x - 2)$ — Subtract each term.
$= x^2 - 5x - 4 - (x^2) - (-4x) - (-2)$ — Add the opposite terms.
$= x^2 - 5x - 4 - x^2 + 4x + 2$ — Collect like terms.
$= x^2 - x^2 - 5x + 4x - 4 + 2$ — Combine like terms.
$= -x - 2$

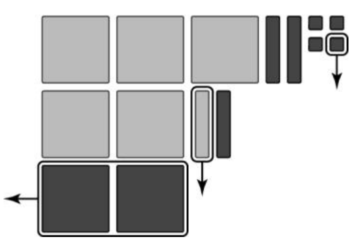
7. a) Display $3s^2 + 2s + 4$. Take away two s^2-tiles, one s-tile, and one 1-tile.

The remaining tiles represent $s^2 + s + 3$.
$(3s^2 + 2s + 4) - (2s^2 + s + 1)$
$= 3s^2 + 2s + 4 - (2s^2) - (+s) - (+1)$
$= 3s^2 + 2s + 4 - 2s^2 - s - 1$
$= 3s^2 - 2s^2 + 2s - s + 4 - 1$
$= s^2 + s + 3$

b) Display $3s^2 - 2s + 4$. Take away two s^2-tiles, one $-s$-tile, and one 1-tile.

The remaining tiles represent $s^2 - s + 3$.
$(3s^2 - 2s + 4) - (2s^2 - s + 1)$
$= 3s^2 - 2s + 4 - (2s^2) - (-s) - (+1)$
$= 3s^2 - 2s + 4 - 2s^2 + s - 1$
$= 3s^2 - 2s^2 - 2s + s + 4 - 1$
$= s^2 - s + 3$

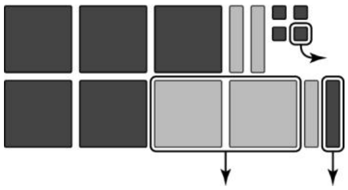
c) Display $3s^2 - 2s - 4$. To take away two $-s^2$-tiles, add 2 zero pairs of s^2-tiles. To subtract one s-tile, add 1 zero pair of s-tiles. Then take away one -1-tile.



The remaining tiles represent $5s^2 - 3s - 3$.
$(3s^2 - 2s - 4) - (-2s^2 + s - 1)$
$= 3s^2 - 2s - 4 - (-2s^2) - (+s) - (-1)$
$= 3s^2 - 2s - 4 + 2s^2 - s + 1$

$= 3s^2 + 2s^2 – 2s – s – 4 + 1$
$= 5s^2 – 3s – 3$

d) Display $–3s^2 + 2s – 4$. To subtract two s^2-tiles, add 2 zero pairs of s^2-tiles. To subtract one $–s$-tile, add 1 zero pair of s-tiles. Then remove one –1-tile.



The remaining tiles represent $–5s^2 + 3s – 3$.
$(–3s^2 + 2s – 4) – (2s^2 – s – 1)$
$= –3s^2 + 2s – 4 – (2s^2) – (–s) – (–1)$
$= –3s^2 + 2s – 4 – 2s^2 + s + 1$
$= –3s^2 – 2s^2 + 2s + s – 4 + 1$
$= –5s^2 + 3s – 3$

8. I used the properties of integers to subtract. I subtracted each term, added opposite terms, collected like terms, then combined like terms.

a) $(3x + 7) – (–2x – 2) = 3x + 7 – (–2x) – (–2)$
$= 3x + 7 + 2x + 2$
$= 3x + 2x + 7 + 2$
$= 5x + 9$
To check, add the difference to the second polynomial:
$(–2x – 2) + (5x + 9) = –2x – 2 + 5x + 9$
$= –2x + 5x – 2 + 9$
$= 3x + 7$
The sum is equal to the first polynomial. So, the difference is correct.

b) $(b^2 + 4b) – (–3b^2 + 7b) = b^2 + 4b – (–3b^2) – (+7b)$
$= b^2 + 4b + 3b^2 – 7b$
$= b^2 + 3b^2 + 4b – 7b$
$= 4b^2 – 3b$
To check, add the difference to the second polynomial:
$(–3b^2 + 7b) + (4b^2 – 3b) = –3b^2 + 7b + 4b^2 – 3b$
$= –3b^2 + 4b^2 + 7b – 3b$
$= b^2 + 4b$
The sum is equal to the first polynomial. So, the difference is correct.

c) $(–3x + 5) – (4x + 3) = –3x + 5 – 4x – 3$
$= –3x – 4x + 5 – 3$
$= –7x + 2$
To check, add the difference to the second polynomial:
$(4x + 3) + (–7x + 2) = 4x + 3 + (–7x) + 2$
$= 4x – 7x + 3 + 2$
$= –3x + 5$
The sum is equal to the first polynomial. So, the difference is correct.

d) $(4 – 5p) – (–7p + 3) = 4 – 5p – (–7p) – (+3)$
$= 4 – 5p + 7p – 3$

$= -5p + 7p + 4 - 3$
$= 2p + 1$

To check, add the difference to the second polynomial:
$(-7p + 3) + (2p + 1) = -7p + 3 + 2p + 1$
$= -7p + 2p + 3 + 1$
$= -5p + 4$, or $4 - 5p$

The sum is equal to the first polynomial. So, the difference is correct.

e) $(6x^2 + 7x + 9) - (4x^2 + 3x + 1) = 6x^2 + 7x + 9 - (4x^2) - (+3x) - (+1)$
$= 6x^2 + 7x + 9 - 4x^2 - 3x - 1$
$= 6x^2 - 4x^2 + 7x - 3x + 9 - 1$
$= 2x^2 + 4x + 8$

To check, add the difference to the second polynomial:
$(4x^2 + 3x + 1) + (2x^2 + 4x + 8) = 4x^2 + 3x + 1 + 2x^2 + 4x + 8$
$= 4x^2 + 2x^2 + 3x + 4x + 1 + 8$
$= 6x^2 + 7x + 9$

The sum is equal to the first polynomial. So, the difference is correct.
So, the difference is correct.

f) $(12m^2 - 4m + 7) - (8m^2 + 3m - 3) = 12m^2 - 4m + 7 - (8m^2) - (+3m) - (-3)$
$= 12m^2 - 4m + 7 - 8m^2 - 3m + 3$
$= 12m^2 - 8m^2 - 4m - 3m + 7 + 3$
$= 4m^2 - 7m + 10$

To check, add the difference to the second polynomial:
$(8m^2 + 3m - 3) + (4m^2 - 7m + 10) = 8m^2 + 3m - 3 + 4m^2 - 7m + 10$
$= 8m^2 + 4m^2 + 3m - 7m - 3 + 10$
$= 12m^2 - 4m + 7$

The sum is equal to the first polynomial. So, the difference is correct.

g) $(-4x^2 - 3x - 11) - (x^2 - 4x - 15) = -4x^2 - 3x - 11 - (x^2) - (-4x) - (-15)$
$= -4x^2 - 3x - 11 - x^2 + 4x + 15$
$= -4x^2 - x^2 - 3x + 4x - 11 + 15$
$= -5x^2 + x + 4$

To check, add the difference to the second polynomial:
$(x^2 - 4x - 15) + (-5x^2 + x + 4) = x^2 - 4x - 15 - 5x^2 + x + 4$
$= x^2 - 5x^2 - 4x + x - 15 + 4$
$= -4x^2 - 3x - 11$

The sum is equal to the first polynomial. So, the difference is correct.

h) $(1 - 3r + r^2) - (4r + 5 - 3r^2) = 1 - 3r + r^2 - (4r) - (+5) - (-3r^2)$
$= 1 - 3r + r^2 - 4r - 5 + 3r^2$
$= r^2 + 3r^2 - 3r - 4r + 1 - 5$
$= 4r^2 - 7r - 4$

To check, add the difference to the second polynomial:
$(4r + 5 - 3r^2) + (4r^2 - 7r - 4) = 4r + 5 - 3r^2 + 4r^2 - 7r - 4$
$= -3r^2 + 4r^2 + 4r - 7r + 5 - 4$
$= r^2 - 3r + 1$

The sum is equal to the first polynomial. So, the difference is correct.

10. a) Choose a value for x, such as $x = 4$.
Substitute $x = 4$ in the addition sentences.

Left side: $(2x^2 + 5x + 10) - (x^2 - 3)$

Right side: $x^2 + 8x + 10$

$= (2(4)^2 + 5(4) + 10) – ((4)^2 – 3)$ $= (4)2 + 8(4) + 10$
$= (32 + 20 + 10) – (13)$ $= 16 + 32 + 10$
$= 49$ $= 58$

Since the left side is not equal to the right side, the answer is incorrect.

b) The student did not subtract like terms; $5x$ and 3 does not equal $8x$; 3 must be added to 10 to give 13.
Corrected solution: $(2x^2 + 5x + 10) – (x^2 – 3)$
$= 2x^2 + 5x + 10 – x^2 + 3$
$= 2x^2 – x^2 + 5x + 10 + 3$
$= x^2 + 5x + 13$

12. a) The student did not add the opposite of each term in the 2nd polynomial being subtracted; the student only added the opposite of the first term.

b) Corrected solution:
$(2y^2 – 3y + 5) – (y^2 + 5y – 2)$
$= 2y^2 – 3y + 5 – y^2 – 5y + 2$
$= 2y^2 – y^2 – 3y – 5y + 5 + 2$
$= y^2 – 8y + 7$

c) The answer can be checked by substitution, or by adding the difference to the second polynomial; if the sum is equal to the first polynomial, the answer is correct.

d) The student will need to focus on adding the opposite of each term in the second polynomial. Checking the answer will also help the student avoid errors.

13. The perimeter is the sum of the measures of all sides.
a) $(6w + 14) – (2w + 3 + 2w + 3) = 6w + 14 – (4w + 6)$
$= 6w – 4w + 14 – 6$
$= 2w + 8$
Since the remaining 2 lengths are equal, each unknown length is $w + 4$.

b) $(7s + 7) – (3s + 2 + 3s + 2) = 7s + 7 – (3s) – (+2) – (+3s) – (+2)$
$= 7s + 7 – 3s – 2 – 3s – 2$
$= 7s – 3s – 3s + 7 – 2 – 2$
$= s + 3$
The unknown length is $s + 3$.

c) $(10p + 8) – (p + 3 + p + 3) = 10p + 8 – (2p + 6)$
$= 10p + 8 – 2p – 6$
$= 8p + 2$
Since the remaining 2 lengths are equal, each unknown length is $4p + 1$.

17. First, find the perimeter of each rectangle:

Perimeter of small rectangle:
$2x + 6 + x + 2 + 2x + 6 + x + 2 = 6x + 16$

Perimeter of large rectangle:
$2x + 1 + 4x + 3 + 2x + 1 + 4x + 3 = 12x + 8$

Then, subtract the perimeter of the small rectangle from the perimeter of the large rectangle to determine the

difference in the perimeters of the rectangles:

$(12x + 8) – (6x + 16) = 12x + 8 – 6x – 16$
$= 12x – 6x + 8 – 16$
$= 6x – 8$

The difference is $6x – 8$.

18. The difference of two polynomials is $–4x^2 + 2x – 5$. So,

$$\begin{array}{r} \square x^2 + \square x + \square \\ - \; \square x^2 + \square x + \square \\ \hline -4x^2 + 2x - 5 \end{array}$$

We need any two coefficients that have a difference of –4 to get the first term; then we need any two coefficients that have a difference of 2 to get the second term; and for the constant term, we need to use any two numbers that have a difference of –5.

There are an infinite number of possibilities. For example,

$(–8x^2 + 4x – 15) – (–4x^2 + 2x – 10) = –8x^2 + 4x – 15 – (–4x^2) – (+2x) – (–10)$
$= –8x^2 + 4x – 15 + 4x^2 – 2x + 10$
$= –8x^2 + 4x^2 + 4x – 2x – 15 + 10$
$= –4x^2 + 2x – 5$

$(–12x^2 + 8x – 20) – (–8x^2 + 6x – 15) = –12x^2 + 8x – 20 – (–8x^2) – (+6x) – (–15)$
$= –12x^2 + 8x – 20 + 8x^2 – 6x + 15$
$= –12x^2 + 8x^2 + 8x – 6x – 20 + 15$
$= –4x^2 + 2x – 5$